Space Weather Technical Forecast

Issued on Friday, 24 June 2022 at 01:10 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of an M-class flare. Active fluence likely by Day 4 (27 June). Slight chance of G1/Minor Storms mainly Day 2 (25 June).

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has remained Low over the past 24 hours, with several C-class flares, including a long-period C4.0 flare from the southwestern horizon, peaking around 23/1120 UTC. There remain issues with the availability of SDO satellite imagery at present, however there appear to be four sunspots on the visible disc. By far the largest remains AR3038 in the northwest, which appears little changed, although the magnetic structure now seems to be more straightforward. Otherwise, the remaining groups appear small and simple, perhaps with some decay.
Analysis of front side potential Coronal Mass Ejection (CME) causing events has been somewhat hampered in the past 24 hours, however there were a few weak CMEs observed. Currently, none of these events are thought to be Earth directed.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, showed potential weak coronal hole influences. Wind speed varied mostly between 450-500 km/s, but with brief variations between 400-550 km/s. The solar wind density was mostly average or below average. The IMF, Bt, was mostly weak, but increased to peak at moderate levels near 9nT around 23/1900 UTC. The north-south component, Bz, varied between +7/-6nT. The phi angle was negative (towards the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) measured by GOES16 remained at background levels through the period.
High energy electron flux (greater than 2MeV) peaked at High levels, with 1180pfu observed at GOES16 at 23/1510 UTC. The corresponding 24-hour integrated electron fluence remained below the Active threshold (1e8 integrated pfu) on a fairly steady trend, with an observed fluence of 3.31e7 integrated pfu at 24/0000UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is likely to be Low, with a daily slight chance of an isolated M-class flare. AR3038 dominates the disc in terms of flare risk and only leaves the disc during Day 4 (27 June), while there are no significant returning regions over the eastern limb.

Solar Wind / Geomagnetic Activity: No CMEs are currently likely to reach Earth. There are two reasonably sized coronal holes on the disc, CH93/- and CH94/-, which may bring elevated or perhaps strong wind speeds, most likely early on Day 2 (25 June).
Geomagnetic activity is expected to be Quiet to Unsettled with a chance of Active intervals and a slight chance of G1/Minor Storms. We usually experience a muted geomagnetic response to coronal hole high speed streams near the solstice, which is the reason for the low probabilities of G1. Activity is expected to become mostly Quiet by Day 4 (27 June).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10 MeV) is

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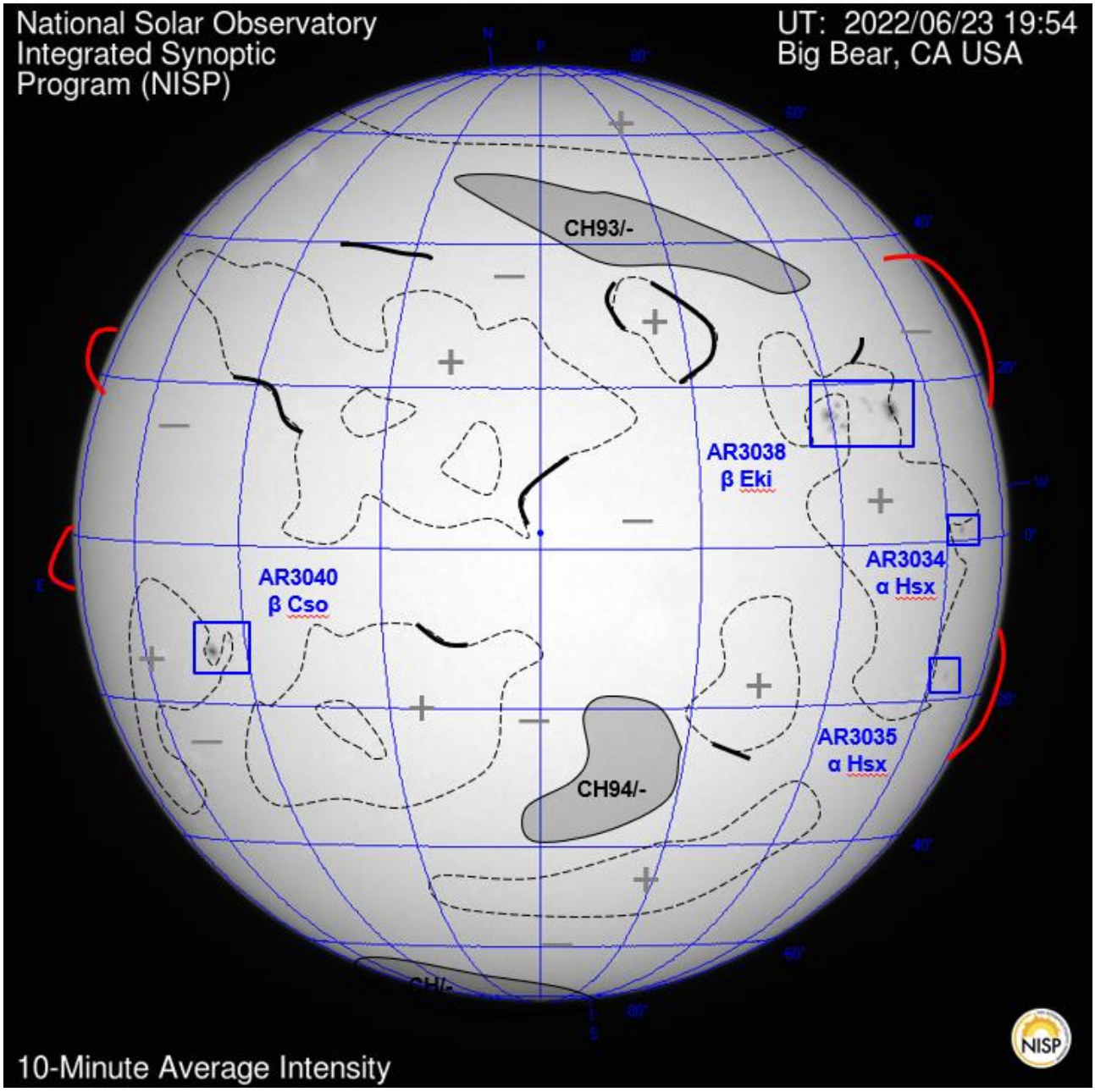
expected to be at background levels during the period, but with a daily slight shance of an S1 or greater event as a result of the large region AR3038 gradually nearing the western limb.
The high energy electron flux (greater than 2 MeV) should show a gradual rising trend in this period, perhaps with some temporary suppression on Day 2 (25 June) due to a potential CIR from a high speed stream arrival. Corresponding electron fluence is therefore expected to be fairly steady through Day 1 (24 June), perhaps with a temporary dip on Day 2, before showing a rising trend through Days 3 and 4 (26-27 June). Active (1e8 integrated pfu) fluence becomes likely by Day 4.

Figure 1. Solar Analysis Valid 23/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs are currently expected to reach Earth. Confidence in this, however, is lower than normal given various disappearing filaments in the past 24 hours and the lower availability of satellite imagery.

There are currently two reasonably sized coronal holes on the disc, CH93/- and CH94/-. As they cover similar longitudes, we are unlikely to be able to distinguish between the high speed streams from these features. STEREO-A MAG and PLASTIC data are indicative of a reasonable size CIR at a time which would equate to an arrival time at Earth early on Day 2 (25 June). Elevated or perhaps strong wind speeds are possible from this feature. The current geometry of these coronal holes bears little resemblance to the previous rotation, which lowers confidence in persistence forecasting.

Geomagnetic activity is expected to be Quiet to Unsettled with a chance of Active intervals and a slight chance of G1/Minor Storms. We usually experience a muted geomagnetic response to coronal hole high speed streams near the solstice, which is the reason for the low probabilities of G1. Activity is expected to become mostly Quiet by Day 4 (27 June).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	20	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
*	*	*	*	*	*	*

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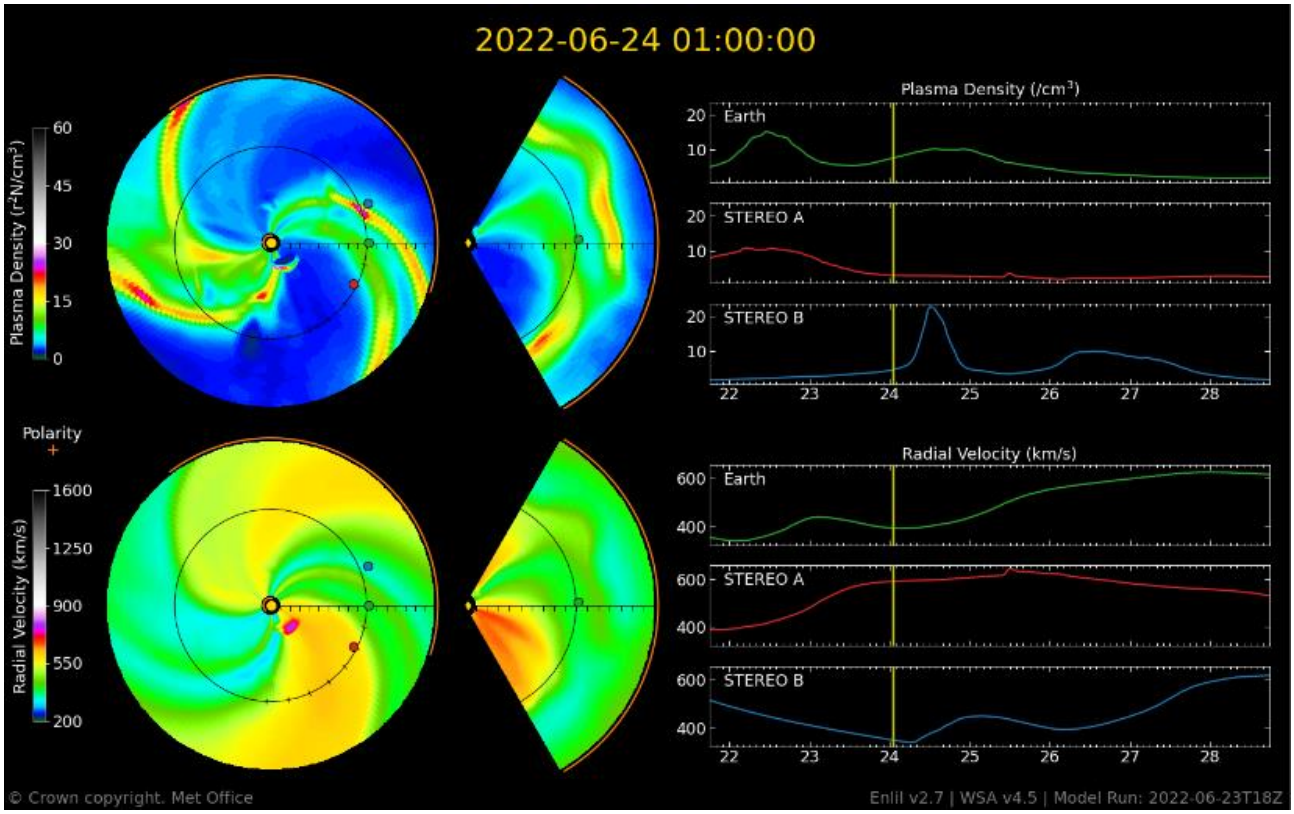
Figure 2: MOSWOC Enlil model, showing a good trend with regards high speed stream timings. Strength is also reasonable, although may be slightly overdone.



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Radio Blackouts - X-Ray Flares:

There are currently four sunspot regions on the solar disc. By far the largest remains AR3038, which showed a slight declining trend during the last 24 hours, and is now classified Eki/Beta. This spot continues to run counter to expectations with little recent flare activity. However, given its classification, it could still spark into life, and is the reason for the slight chance of M-class activity through this period. All other spots were unremarkable in the past 24 hours, with AR3040 in particular showing decay.

Overall, no significant new regions are expected to rotate onto the disc in the coming days. AR3038 is expected to leave the disc during Day 4 (27 June), but will still be in a position to give a continued flare risk until the end of Day 4. For this reason, the flare probabilities remain the same through the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at background levels, and will most likely remain at this level through the period given the observed lack of activity from the main sunspot region on the disc, AR3038.

There is a nominal slight chance of an S1 or greater event through the next four days with AR3038 in the western hemisphere. However, this region has been somewhat more subdued than its Zurich class implies, with no recent history of large flares or associated proton events.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	5	5	5
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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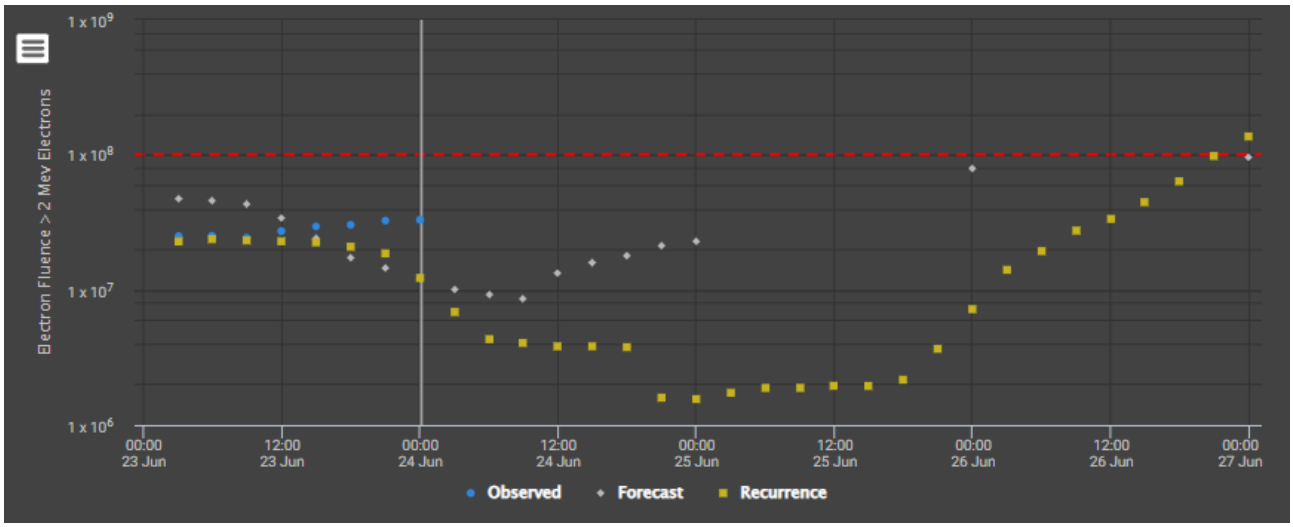
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2 MeV) should show a gradual rising trend in the four days, perhaps with some temporary suppression on Day 2 (25 June) due to a potential CIR from a high speed stream arrival. Wind speeds are expected to rise early on Day 2 as we see the high speed stream(s) from CH93/- and CH94/-. Electron flux is currently peaking just at High levels, and a rise is likely in response to the expected wind speed increase on Day 2.

Corresponding electron fluence is therefore expected to be fairly steady through Day 1 (24 June), perhaps with a temporary dip on Day 2, before showing a rising trend through Days 3 and 4 (26-27 June). Active (1e8 integrated pfu) becomes likely by Day 4. REFM is considered to be showing reasonable guidance at present, with a rise to just below the Active threshold by Day 3.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\,sr^{-1}\,day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	10	30	50
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: MOSWOC REFM showing a reasonable trend through this period.



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